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**Information Superiority,
Network Centric Warfare
and the
Knowledge Edge**

Martin Burke

DSTO-TR-0997

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Information Superiority, Network Centric Warfare and the Knowledge Edge

Martin Burke

Joint Systems Branch
Electronics and Surveillance Research Laboratory

DSTO-TR-0997

ABSTRACT

The report notes that a socio-cultural phenomenon has occurred in the Defence community whereby it has become commonplace for the assumption to be made that success in various types of modern warfare will be assured if Information Superiority can be achieved. It presents outline arguments that suggest that this assumption is fallacious. It concludes that:

- Success in Network Centric Warfare requires Knowledge Superiority and benefits from Information Superiority.
- Success in Manoeuvre Warfare requires Knowledge Superiority and benefits from Information Superiority.
- A Decision Edge requires a Knowledge Edge and benefits from an Information Edge.

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Information Superiority, Network Centric Warfare and the Knowledge Edge

Executive Summary

The report notes that a socio-cultural phenomenon has occurred in the Defence community whereby it has become commonplace for the assumption to be made that success in various types of modern warfare will be assured if Information Superiority can be achieved. In an attempt to redress this phenomenon, it presents outline arguments that suggest that this assumption is fallacious. The arguments are constructed using ideas drawn from prominent Defence publications. Definitions and explanations of fundamental concepts are provided as appropriate.

It begins with a brief description of the context in which the socio-cultural phenomenon has occurred. The description is framed in terms of key extracts from US *Joint Vision 2010* (JV2010), [DOD 1997], and *Australia's Strategic Policy* (ASP97), [Defence 1997].

It then addresses the significance of Information Superiority and Knowledge Superiority in Network Centric Warfare. By referring to the recently published *Network Centric Warfare*, [Alberts, Garstka et al. 1999] and drawing an analogy with a "quasi-case-study", it constructs an argument that concludes that:

Success in Network Centric Warfare requires Knowledge Superiority and benefits from Information Superiority.

It continues by considering the salient relationships between Decision Superiority and Manoeuvre Warfare; Knowledge Superiority and Knowledge Warfare. An analysis based on '*Decisive Manoeuvre: Australian Warfighting Concepts to Guide Campaign Planning*', [Defence 1998] leads to the following conclusion:

Success in Manoeuvre Warfare requires Knowledge Superiority.

It then addresses the significance of Information Superiority and Knowledge Superiority in Manoeuvre Warfare. Further extracts from *Decisive Manoeuvre* are combined with intermediate conclusions made in previous reasoning to conclude that:

Success in Manoeuvre Warfare requires Knowledge Superiority and benefits from Information Superiority.

It continues by considering the nature of the Knowledge Edge and its relationships with the Decision Edge and the Information Edge. By making some plausible assumptions, the reasoning is extended to conclude that:

A Decision Edge requires a Knowledge Edge and benefits from an Information Edge

The report closes with a brief discussion of the preceding analyses and some provisional recommendations regarding future work.

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Martin Burke holds the position of Architecture Mentor in Joint Systems Branch where he conducts research in the emerging fields of Thought Systems, Architecture Meta-Thinking and Multi-Disciplinary Thinking. He is also an Adjunct Senior Research Fellow at the Systems Engineering and Evaluation Centre at the University of South Australia and an Associate of the Centre for Business Dynamics and Knowledge Management at the Australian Defence Force Academy, University of New South Wales.

At other stages of his career, Martin has held research and management positions in ITD's Information Architectures Group, ITD's Software Systems Engineering Group, the UK Atomic Energy Authority, the SEMA Group Research Centre and Rolls Royce (Aero).

Martin has a BSc (Hons) in Physics, a MSc in Mathematical Statistics and a PhD in Engineering Mathematics.

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1. Introduction

1.1 Context

This report is an output of a research effort initiated within the Joint Systems Branch of DSTO. It has been carried out as part of DSTO Task JNT 99/018 (Architecture Support and Technology). Dr Michael Jarvis of the Capability Analysis Staff has been the primary point of contact in Australian Defence Headquarters for the work.

1.2 Readership

The report has been written to be read by members of the Defence community, particularly those concerned with Network Centric Warfare and the Knowledge Edge. No particular academic background has been assumed of its readership. All arguments developed in the report are couched in terms of concepts that are introduced in the report.

1.3 Background

US *Joint Vision 2010* (JV2010), [DOD 1997], is "the conceptual template for how America's Armed Forces will channel the vitality and innovation of our people and leverage technological opportunities to achieve new levels of effectiveness in joint warfighting." It stresses the importance of achieving "dominant battlespace awareness" through the superior use of systems of systems that harness improvements in information and systems integration technologies. It introduces the idea of 'Information Superiority' and suggests that it is necessary and sufficient in achieving "dominant battlespace awareness".

'We must have information superiority: the capability to collect, process, and disseminate an uninterrupted flow of information while exploiting or denying an adversary's ability to do the same.'

p 16

'The basis of this framework is found in the improved command, control and intelligence which can be assured by information superiority.'

p 19

(Underlinings added)

Australia's Strategic Policy (ASP97), [Defence 1997], establishes the direction for Australian defence planning into the 21st century. It explains that, "in modern warfare, the business of winning will increasingly begin by knowing as much as possible about an adversary and their intentions." It designates the 'Knowledge Edge' as the "highest capability development priority" where the term 'Knowledge Edge' is used to refer to "the effective exploitation of information technologies to allow us to use our relatively

small force to maximum effectiveness.” A large proportion of the Australian Defence community has taken this last clause to act as a definition of the concept of Knowledge Edge.

Neither JV2010 nor ASP97 emphasise the significance of ‘Knowledge Superiority’ in modern warfare. (The term ‘Knowledge Superiority’ is used in the report to refer to “the ability to out-wit an adversary”). Although both acknowledge the importance of people and their knowledge to Defence capability, neither explicitly stress the importance of the role of humans as the (principal and most adaptive) knowledge agents needed to make sense of the information in Defence systems. The documents are often interpreted as suggesting that Knowledge or Network Centric Warfare¹ will be won by being better informed than adversaries rather than being able to out-wit them². Arguably as a result of this, it has become commonplace in both the US and Australian Defence communities for the assumption to be made that success in modern warfare will be assured if Information Superiority can be achieved. Examples of Defence initiatives that appear to be based on this assumption include the:

- Australian Defence Information Environment, [Chin 1999], [Burns 2000];
- Australian Project Takari, [Chessell 1997], [Takari 2000];
- US C4ISR Architecture Framework³, [C4ISRAWG 1997].

This situation can be interpreted as a socio-cultural phenomenon, in which factors other than rational thought have dominated⁴. Although no attempt will be made in this report to analyse the phenomena from the socio-cultural perspective, a conceptual framework that supports such work has been developed and is reported in [Burke 2000]; the concept of Culture System that it originates is particularly relevant. An introduction to the framework is provided in a companion report, entitled *Thought Systems and Network Centric Warfare*, [Burke 2000].

1.4 Objectives, Approach and Structure

In an attempt to redress the socio-cultural phenomenon described above, the report argues against the validity of the assumption, prevalent in some parts of Defence, that “success in modern warfare will be assured if Information Superiority can be achieved”.

¹ In a companion report to this, entitled *Thought Systems and Network Centric Warfare*, [Burke 2000], it is argued that the scope of NCW can be considered to be, broadly speaking, the same as what the Tofflers’, [Toffler and Toffler 1993] mean by the term “Knowledge Warfare”.

² Appendix A addresses the differences between Information Warfare and Knowledge Warfare.

³ This is addressed by a paper entitled *Assessing the C4ISR Architecture Framework for the Military Enterprise*, [Cook, Kasser et al. 2000], submitted to ICCRTS2000.

⁴ This is a particularly intriguing example of a socio-cultural phenomenon due to the widespread extent of the misconception and the depth of conviction with which the misconception has been accepted, professed and acted upon.

It does this by constructing simple, "common sense", outline arguments using ideas drawn from prominent Defence publications. Definitions and explanations of fundamental concepts are provided as appropriate.

It begins by addressing the significance of Information Superiority and Knowledge Superiority in Network Centric Warfare (Section 2). As a preliminary to addressing the significance of Information Superiority and Knowledge Superiority in Manoeuvre Warfare (Section 4), it considers the salient relationships between Decision Superiority and Manoeuvre Warfare; Knowledge Superiority and Knowledge Warfare (Section 3). Section 5 considers the nature of the Knowledge Edge and its relationships with the Decision Edge and the Information Edge. It concludes with a brief discussion of the preceding analyses and draws some provisional conclusions.

2. Information Superiority, Knowledge Superiority and Network Centric Warfare

The recently published *Network Centric Warfare*, [Alberts, Garstka et al. 1999], also attempts to dispel the misunderstanding that "success in modern warfare will be assured if Information Superiority can be achieved". It defines NCW as:

'... an information superiority-enabled concept of operation that generates increased combat power by networking sensors, decision makers, and shooters to achieve shared awareness, increased speed of command, higher tempo of operations, greater lethality, increased survivability, and a degree of self-synchronization. In essence, NCW translates information superiority into combat power by effectively linking knowledgeable entities in the battlespace.'

p 2

It explains that:

'... the power of NCW is derived from the effective linking or networking of knowledgeable entities that are geographically or hierarchically dispersed. The networking of knowledgeable entities enables them to share information and collaborate to develop shared awareness, and also to collaborate with one another to achieve a degree of self-synchronisation.'

p 6

It also re-defines Information Superiority as:

'... a state that is achieved when a competitive advantage is derived from the ability to exploit a superior information position.'

p 32

This report contends that this revised view, despite being broader than that of JV2010 in that it encompasses the interaction of "knowledgeable entities" and information, is also misleading. A competitive advantage in NCW does not necessarily require "a superior information" position if a protagonist can "out-wit" an adversary without

being better informed than it. Appendix B, provides a lighted-hearted “quasi-case-study” that, by analogy, affords useful insight into this relationship.

This can be summarised as:

Success in Network Centric Warfare requires Knowledge Superiority and benefits from Information Superiority.

3. Decision Superiority and Manoeuvre Warfare; Knowledge Superiority and Knowledge Warfare

‘Decisive Manoeuvre: Australian Warfighting Concepts to Guide Campaign Planning’, [Defence 1998] is intended to guide the Australian Defence Force in the application of combat power at the operational level of war. It states that the focus of the Australian operational art must be on the ‘Manoeuvre Warfare’ in which the intent is “to impose our will on the adversary by gaining and maintaining the initiative”. It regards ‘Decisive Manoeuvre’ as the overarching warfighting concept in ‘Manoeuvre Warfare’. It defines ‘Decisive Manoeuvre’ as follows:

‘Decisive Manoeuvre’ is the conduct of synchronised operations using assets from and within any or all environments to defeat the adversary by positioning in time and space the most appropriate force to threaten or attack critical vulnerabilities, thereby unhinging the centre of gravity and obtaining maximum leverage.’

Para 1.9

It provides the following definition of ‘Decision Superiority’:

‘Decision Superiority is the concept which supports all others. Manoeuvre warfare has been described as a race against time, and Australia’s limited resources and likely reactive posture at the outset make it all the more important that the ADF is an organisation imbued with the concepts of directive control, possessing a robust command, control and communications system and capable of maintaining a decision tempo faster and more effective than that of the adversary. To achieve such a tempo, the ADF must be capable of a superior use of knowledge to that of its opposition, both to support its own operations and to hinder those of its enemy. This agility of mind must, of course be matched by agility of action.’

Para 1.17

(Underlining added)

This provides an insight into the nature of relationships between ‘Manoeuvre Warfare’ and ‘Knowledge Warfare’ and ‘Decision Superiority’ and ‘Knowledge Superiority’. The salient aspects of the above can be summarised as follows:

- Manoeuvre Warfare is the focus of modern warfare in the Australian context;

- Manoeuvre Warfare encompasses Knowledge Warfare⁵;
- Success in Manoeuvre Warfare requires Decision Superiority;
- Success in Knowledge Warfare requires Knowledge Superiority;
- Decision Superiority requires Knowledge Superiority.

It follows from this that:

Success in Manoeuvre Warfare requires Knowledge Superiority.

4. Information Superiority, Knowledge Superiority and Manoeuvre Warfare

The following extract from *Decisive Manoeuvre* clarifies the relationship between Decision Superiority and Information Superiority:

'Conflict is a dynamic process in which the results of planned actions cannot be predicted with certainty. Even the best plan will not survive the first engagement with the adversary completely intact. To be effective Decisive Manoeuvre requires processes in place to monitor the situation as the conflict unfolds and to be able to react to developments faster than the adversary. This requirement is enabled by Decision Superiority, enhanced by superior information management and ensured by Robust Security.

Para 3.10

(Underlining added)

The salient aspects of this can be summarised as follows:

- Success in Manoeuvre Warfare requires Decision Superiority;
- Success in Manoeuvre Warfare benefits from Information Superiority.

Combining these with the salient points from Section 3 gives:

Success in Manoeuvre Warfare requires Knowledge Superiority and benefits from Information Superiority.

5. Decision Edge, Knowledge Edge and Information Edge

It is also suggested that the above analysis may give a clearer understanding of the nature of the 'Knowledge Edge' than that which has been popularly inferred from ASP97.

⁵ Since Network Centric Warfare is considered to be, broadly speaking, the same as Knowledge Warfare, this implies that Manoeuvre Warfare encompasses Network Centric Warfare.

First let us assume that an “Edge” exists between adversaries in respect to a particular type of warfare when one adversary has “Superiority” over the other(s) in that regard. In particular:

- in Manoeuvre Warfare, a Decision Edge exists between adversaries when one has Decision Superiority over the other(s);
- in Knowledge Warfare, a Knowledge Edge exists between adversaries when one has Knowledge Superiority over the other(s);
- in Information Warfare, an Information Edge exists between adversaries when one has Information Superiority over the other(s).

Combining these points with the conclusions of Section 4 gives:

A Decision Edge requires a Knowledge Edge and benefits from a Information Edge

This is emphasised by the following extract from *Decisive Manoeuvre*:

'For Innovation to have the desired effects, it must be based on comprehensive knowledge of both the adversary's strengths and weaknesses and probable intent, and of our own force capabilities. There is no point in devising a brilliantly innovative course of action that is not achievable with assigned forces. Innovative courses of action must be founded on a detailed knowledge of the strategic and tactical environments to minimise the possibility of unwanted effects.'

Para 4.18

(Underlining added)

Furthermore, the extract highlights that any characterisation of the Knowledge Edge requires not just an understanding of the Knowledge Warfare capability of the ADF and its allies but also an understanding of the Knowledge Warfare capabilities of all (potential) enemy military forces⁶.

It is suggested that profound differences could exist between the natures of the bodies of knowledge in opposing military forces. It is also suggested that a vital feature in achieving and maintaining Knowledge Edge will be to have understandings of the knowledge in the ADF and the (potential) enemy enterprises and to know how this can be exploited.

Furthermore, it is suggested that that Knowledge Superiority over one potential enemy does not imply Knowledge Superiority over a second enemy even though it is known that the first enemy does have Knowledge Superiority over the second⁷. That is, it

⁶ Note the similarity to ASP97 in this respect.

⁷ In considering this issue it may be helpful to bear in mind the metaphor of the ancient game of “Stone - Scissors - Paper”. In the game, despite the fact that the Stone “blunts” the Scissors and the Scissors “cuts” the Paper, the Paper nevertheless “wraps” the Stone.

should not be assumed that Knowledge Superiority is transitive in the set of possible adversaries.

Also, it is contended that the Knowledge Edge is a dynamic and constantly changing phenomenon that emerges from the interaction of allies and adversaries' systems whose components include (at least) information and knowledge components; a much richer concept than can be inferred from a literal interpretation of the ASP97 "definition".

6. Discussion and Conclusions

The report has observed that a socio-cultural phenomenon has occurred in the Defence community whereby it has become commonplace for the assumption to be made that success in various types of modern warfare will be assured if Information Superiority can be achieved. It has presented outline arguments that suggest that this assumption is fallacious. It has concluded that:

- Success in Network Centric Warfare requires Knowledge Superiority and benefits from Information Superiority.
- Success in Manoeuvre Warfare requires Knowledge Superiority and benefits from Information Superiority.
- A Decision Edge requires a Knowledge Edge and benefits from an Information Edge

Although it is appreciated that the arguments are not entirely rigorous it is maintained that, nevertheless, they are plausible and, since they are largely based on "doctrinal" sources, they may help "turn the tide" of popular opinion in these respects.

On the basis of this preliminary discussion, the report concludes that the Knowledge Edge, Australia's highest Defence priority, is not a static and stable phenomenon which can be readily achieved or even understood, but rather one that is dynamic, volatile and elusive in nature. This indicates that fundamentally different methods will be needed to analyse and manage such a phenomenon than are in common use in the Australian Defence community today. Mastering such methods can be anticipated to pay major dividends in future warfare. The report recommends, therefore, that a program of work be conducted to research these issues and that its findings be propagated widely within Defence. Preliminary work on the new ideas of Thought Based War and Anti-War (TBWAW) and Thought Systems, intended to provide a conceptual framework for such a program, has begun, [Burke 2000]. An introduction to the framework is provided in a companion report, entitled *Thought Systems and Network Centric Warfare*, [Burke 2000].

It is possible that the definition of the concept of Knowledge Edge may be reconsidered in the Defence White Paper planned to supersede ASP97. The analysis presented in the report may be beneficial to those involved in its development

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Appendix A: Information Warfare and Knowledge Warfare

Philippe Baumard's paper, 'From InfoWar to Knowledge Warfare: Preparing for the Paradigm Shift' [Baumard 1996]⁸, addresses how the nature of Knowledge Warfare differs from that of Information Warfare. Philippe Baumard is Professor of Strategic Management, University of Paris-XII.

Two key extracts from the paper are given below.

"Thus, it gives the illusion that the development of an information structure is a necessary and sufficient condition to attain a national knowledge infrastructure. On the contrary, such a policy will prove to be counter-productive. It will eventually create an isolated body of upper-level knowledge, disconnected with the reality of social development and learning, and therefore, increasing the gap between people who act, learn and talk, and people being acted, learned and talked." p 5

"As Wilensky once put it, "information has always been a source of power, but it is now increasingly a source of confusion. In every sphere of modern life, the chronic condition is surfeit of information, poorly integrated or lost somewhere in the system", [Wilensky 1967]. Roots of such failures can be found (a) in the persistent confusion between knowledge and information, (b) on the large-scale focus that has been given in education to cumulating of knowledge-bases vs. permanent improvement of the diversity and flexibility of modes of knowing, and (c) in the failure of scientists in integrating in new organizational forms and purposes, the advancements of social cognition and collective learning. Yet, "managers are becoming increasingly aware that informed adaptability is at a premium and to attain it they may need different modes of organization to find and solve different types of problems". Nevertheless, and consistent with a perception of knowledge as a commodity, "organization" on one side, and "knowledge" on the other side, are systematically approached distinctively. Organization theorists propose many alternatives and original organizational forms, but leave managers with the duty of generating adequate knowledge to operate them. Knowledge sociologists put much emphasis on the many forms of socializations that participate in the building of cognitive skills, but are reluctant to study how organizational design and knowledge generation interact. " p 6

⁸ Baumard's paper is available at:
<http://www.indigo-net.com/annexes/289/baumard.htm>

Appendix B: Kasparov versus Kasparov

Appendix B is a lighted-hearted "quasi-case-study" that, by analogy, affords useful insight into the inter-dependence of information and knowledge in warfare. It is stressed that this is a fictional example; any resemblance to real persons, living or dead, is entirely co-incidental!

Comrade Kasparov is a fanatical chess player. Furthermore, she is an avid student of the game and has studied all of the major chess texts and analysed most of the great matches between the masters in recorded history.

When her son, Gary, is born, his mother is delighted. She introduces him to the game at a very early age, taking the role of his only coach, and either oversees or takes part in every game that her boy ever plays.

At the age of four, before Gary can read, he beats his mother for the first time. In the game, since it is played according to the usual conventions, both players have exactly the same information about that specific game. Comrade Kasparov has, of course, a vastly superior experience of chess than her son. Indeed, her son has had no access to information regarding chess that his mother has not. In fact, all of his information on chess has either been provided by his mother or shared directly with her. Nevertheless, despite this apparently overwhelming disadvantage, his precocious talent has enabled him to develop knowledge of how to play and win at chess that is superior to his mother's.

This provides an example that information superiority is not necessary to win in knowledge intensive conflict. Interesting points to note are that:

- Both players had identical and complete information of the game as it was played;
- Comrade Kasparov had vastly more information on chess than her son;
- Gary Kasparov had no relevant information that his mother did not.

It also provides an example that information superiority is not necessary to develop knowledge superiority. Indeed, it demonstrates that circumstances exist in which the ability to learn and to apply knowledge can be a much more important factor than access to information.

It also highlights that there is more than one type of information and that the differences between these types can be significant. In this case there are at least the following types:

- The information encoded in the DNA which the mother and child share;

- The information in the brains of the players concerning the particular game in question due to their observation of the positions of the players on the board during the progress of the game;
- The information recorded in the chess texts and match transcripts which Comrade Kasparov had read and interpreted;
- The information passed on from the mother to the son in the course of her teaching and coaching.

Finally, the case also proves that, in some cases at least, mind can prevail over *mater*!

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19. ABSTRACT The report notes that a socio-cultural phenomenon has occurred in the Defence community whereby it is has become commonplace for the assumption to be made that success in various types of modern warfare will be assured if Information Superiority can be achieved. It presents outline arguments that suggest that this assumption is fallacious. It concludes that: <ul style="list-style-type: none"> • Success in Network Centric Warfare requires Knowledge Superiority and benefits from Information Superiority. • Success in Manoeuvre Warfare requires Knowledge Superiority and benefits from Information Superiority. • A Decision Edge requires a Knowledge Edge and benefits from an Information Edge. 					